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HYDROGEN-ION STUDIES

V. CHANGES IN THE REACTION OF THE BLOOD IN EXPERIMENTAL INFECTIONS *

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Although there are many statements to the effect that acidosis accompanies acute infections, there seems to be in the literature only the work of Dragstedt¹ on the reaction of the blood in experimental infections, measured by the Levy, Rowntree, and Marriott colorimetric method, and the studies by Means² and his associates on the acid-base balance of the blood in pneumonia in which the reaction of the blood was determined by constructing carbon dioxid diagrams according to Haggard and Henderson. These reports all mention changes in the reaction of the blood; namely, a decrease in its alkalinity. The gas-chain method for determining the H-ion concentration of the blood, when properly carried out, probably detects minute changes in reaction more precisely than either of the methods mentioned, or others whereby the P_H is determined directly or indirectly. Since the entire range of reaction of the blood compatible with life lies between P_H 7 and P_H 7.8,³ minute changes are significant. Other studies⁴ have demonstrated that the alkali reserve of the blood in rabbits is lowered in experimental infections. This is a similar study in which the reaction of the blood has been determined directly according to the gas-chain method.

The bacteria were grown on plain agar, and fractional amounts of an 18-hour growth, suspended in sterile 0.9% sodium chlorid solution (not more than 2 c c volume), were injected intravenously into rabbits. The blood in 10 c c quantities was drawn aseptically without anesthesia from the heart into a defibrinating tube, all of the air being displaced. After defibrination by shaking, the blood was introduced directly into

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¹ Jour. Infect. Dis., 1920, 27, p. 452.

² Jour. Exper. Med., 1921, 33, p. 201; Jour. Biol. Chem., 1922, 50, p. 413.

³ Jour. Biol. Chem., 1921, 48, p. 154.

⁴ Hirsch, E. F.: Jour. Am. Med. Assn., 1920, 75, p. 204; Jour. Infect. Dis., 1921, 28, p. 275.

a McClendon electrode vessel without loss of carbon dioxide or the introduction of air. All of the readings were made at a constant temperature of 25 C. The carbon dioxide binding power of the blood was estimated according to the method of Van Slyke and Cullen.⁵ Each rabbit was bled immediately before receiving the injection of bacteria, and once again 2 to 4 hours after, as a rule, but sometimes again during the next day.

TABLE 1
RESULTS OF EXPERIMENTS

Organisms	Before Injection		After Injection		Result
	P _H	CO ₂	P _H	CO ₂	
<i>B. typhosus</i>	7.46	64.31	7.22	49.26	Recovered
<i>B. typhosus</i>	7.50	41.44	6.74	17.76	Died
<i>B. dysenteriae</i> (Flexner).....	7.42	53.61	7.46	49.26	Recovered
<i>B. dysenteriae</i> (Flexner).....	7.42	64.14	7.22	26.39	Died
<i>B. paratyphosus</i> A.....	7.50	43.85	7.34	48.24	Died after 3 days
<i>B. paratyphosus</i> B.....	7.58	60.32	7.41	43.99	Died
			7.49	37.28	
<i>B. enteritidis</i>	7.55	47.57	6.87	26.21	Died
<i>B. mucosus</i>	7.49	59.55	7.32	37.34	Died
10 cc 0.9% NaCl solution....	7.52	65.25	7.44	62.37	No unusual symptoms

The results of these experiments are collected in the table, and they show that the intravenous injection of a suspension of pathogenic bacteria is followed not only by a depression of the alkaline reserve of the blood, but also by a diminution of its alkalinity. The blood of rabbits subjected only to the manipulation incident to bleeding from the heart and the intravenous injection of 10 cc of a 0.9% sodium chlorid solution changed slightly in reaction and in alkaline reserve, but not so much as that of rabbits injected with the bacteria. Those rabbits whose blood reaction and alkaline reserve were changed moderately recovered, those with marked changes died, and in some death occurred at a time when further determinations could not be made. Probably, therefore, some of the values obtained after the injection of the bacteria are much higher than those which actually existed at death.

SUMMARY

The intravenous injection of pathogenic bacteria into rabbits diminishes the alkalinity of the blood as well as the alkaline reserve.

The hydrogen-ion concentration of the blood may become so great that the reaction becomes slightly acid.

⁵ Jour. Biol Chem, 1917, 30, p. 289.